

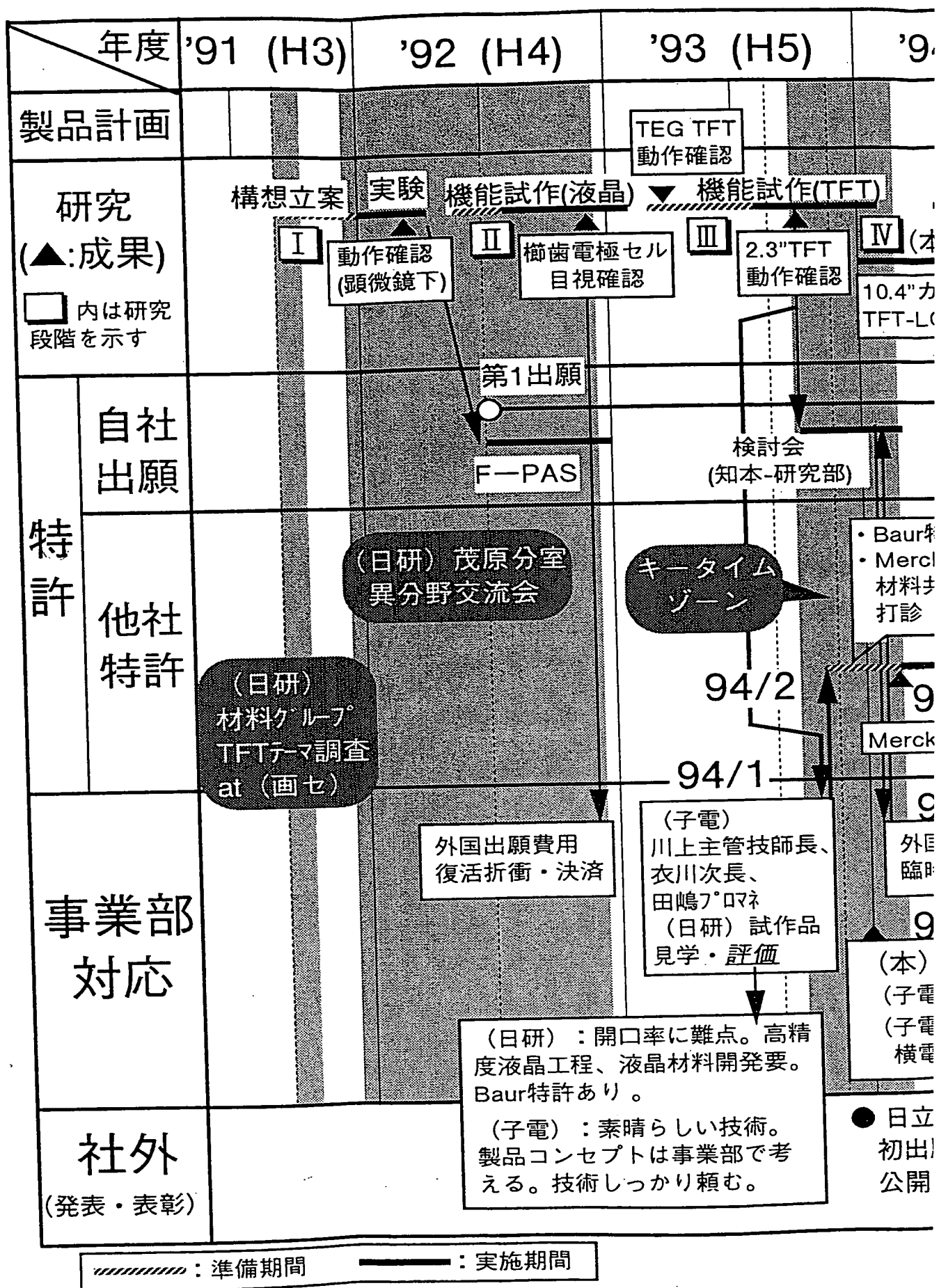
# スーパー T F T 受賞記念

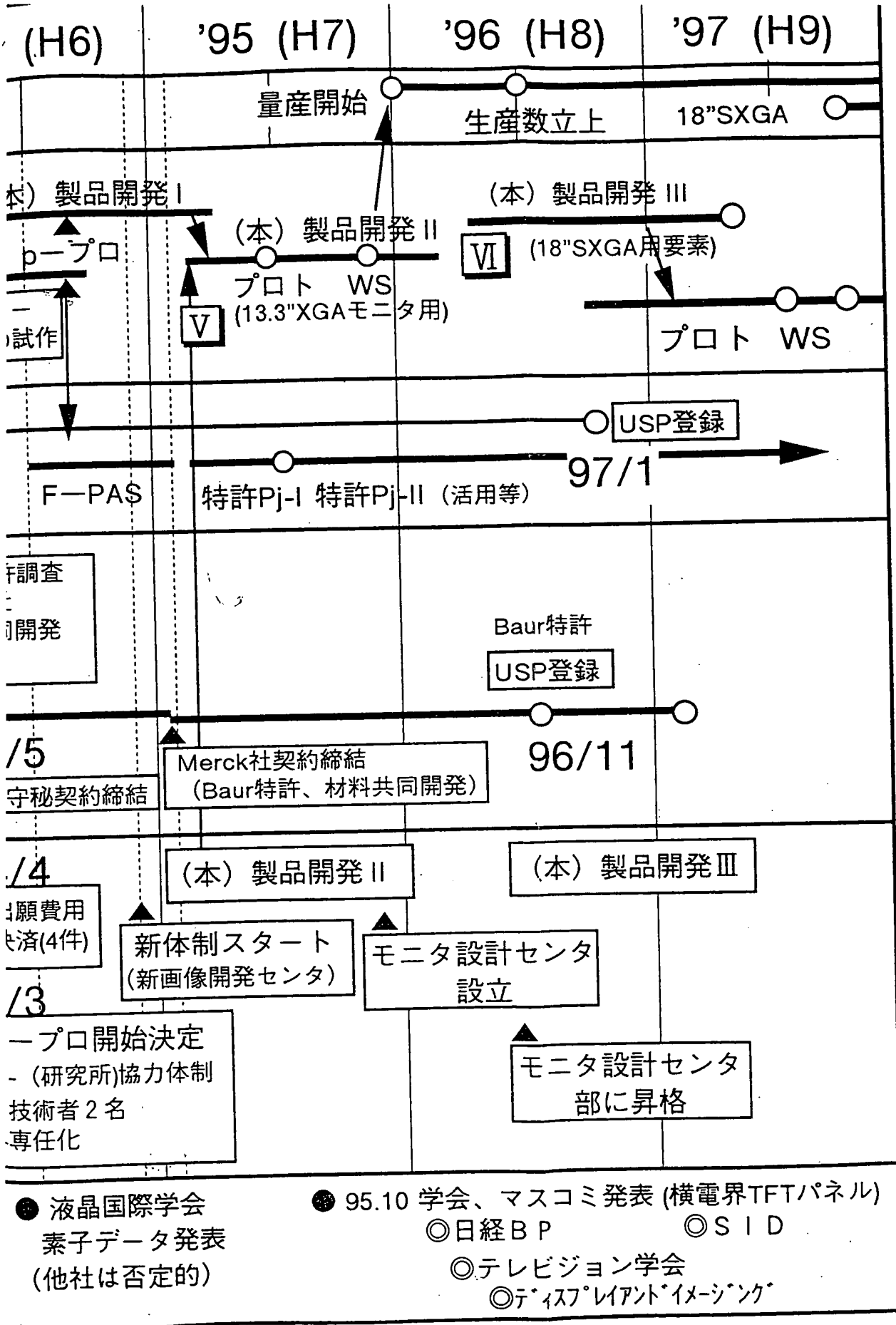
1997年3月13日

## 受賞リスト

- 1) 1996年日経 B P 技術賞 大賞 ('96.4)  
" C R T なみの画質を実現可能な「スーパー T F T 技術」"  
(株) 日立製作所  
日立研究所画像デバイス研究部 主任研究員 近藤 克己  
電子デバイス事業部画像開発センタ 技師 太田 益幸  
電子デバイス事業部画像開発センタ 技師 大江 昌人
- 2) (社) テレビジョン学会 藤尾記念賞 ('96.5)  
" 超広視野角スーパー T F T 液晶ディスプレイの開発"  
(株) 日立製作所スーパー T F T 開発グループ  
代表 近藤 克己
- 3) アドバンスド ディスプレイ オブ ザ イヤー'96、  
ディスプレイ モジュール部門 グランプリ ('96.7)  
(主催: ディスプレイアンドイメージング、  
共催: リード・エグジビジョン・ジャパン (株) )  
" 超広視野角を実現した大画面高精細のスーパー T F T 技術"  
(株) 日立製作所  
(近藤 克己、真野 宏之、太田 益幸、大江 昌人)
- 4) The Society for Information Display、  
1996 Display of the year award, Best of the year ('97.5)  
" Hitachi's 13.3-in. Super TFT-LCD with In-Plane Switching"  
Hitachi, Ltd.

## スーパーTFT 研究～製品化の経過





1996年

# 日経BP技術賞

## 大賞

CRT なみの画質を実現可能な  
「スーパー TFT 技術」

株式会社日立製作所

日立研究所画像デバイス研究部 主任研究員

電子デバイス事業部画像開発センター 技師

電子デバイス事業部画像開発センター 技師

近藤 克己 殿

太田 益幸 殿

大江 昌人 殿

上記の技術は、1996年日経BP技術賞で

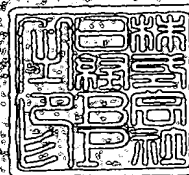
頭書の賞に選ばれました。

ここにこれを賞します。

1996年11月5日

日経BP社

代表取締役 鈴木 隆



Nikkei Business Publications, Inc.

# 藤尾記念賞

株式会社日立製作所

スパード下開発グループ 殿

あなたは一致協力して液晶ディスプレイ  
の欠点である視野角特性の抜本的改善の  
研究に取組み横電界液晶と下下下技術  
を組合わせた新しい液晶ディスプレイ構成  
を開発し実用性を確証されました  
本研究による超広視野角スパード下  
液晶ディスプレイの視野角は百四十度を  
超え今後の画像表示システムの発展に  
大きく寄与するものと期待されます  
よってここに藤尾記念賞を贈呈いたします

平成八年 十五日

社団法人 光学学会

会長 高木幹雄

ITE

# 表彰状

第1回アドバンス・ディスプレイ・オブ・ザ・イヤー'96  
ディスプレイモジュール部門  
グランプリ

CRT並みの画質を実現可能な「スーパーTFT技術」

株式会社日立製作所 殿

貴殿は過去1年間を通してディスプレイ産業の  
発展に大きく貢献する最も優秀なる技術  
製品を開発されました

よってここに栄誉を称えこれを表彰いたします

1996年7月3日

主催「ディスプレイ アンド イメージング」

共催 リードエグジビション ジャパン株式会社

サイエンス・コミュニケーションズ・インターナショナル(株)

会長 Martin B. Gordon



YTH TRANSLATION  
Awards for Hitachi Super-TFT

Super-TFT Award Commemoration

March 13, 1997

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Award List

- 1) 1996 Nikkei BP Technical Award. Grand prize (April 1996)  
"Super-TFT Technology: Capable of realizing the CRT comparative image quality"  
Hitachi Co., Ltd.  
Katsumi Kondo, Chief Researcher. Hitachi Research Center, Image Device Research Division  
Masuyuki Ohta, Technical Staff, Electron Tube & Device Division Image Development Center  
Masato Oh-e, Technical Staff, Electron Tube & Device Division Image Development Center
- 2) Television Society, Inc., Fujio Commemorative Award (May, 1996)  
"Development of Super-TFT LCD with an ultra-wide viewing angle"  
Super-TFT Development Group. Hitachi Co., Ltd.  
Representative: Katsumi Kondo
- 3) Advanced Display of the Year '96 (July 1996)  
Display Module Section, Grand Prix  
(Sponsored by: Display and Imaging and Co-sponsored by: Lead Exhibition Japan, Ltd.)  
"Large screen size and high precision super-TFT technology with an ultra-wide viewing angle"  
Hitachi Co., Ltd.  
(Katsumi Kondo, Hiroyuki Mano, Masuyuki Ohta, and Masato Oh-e)

YTH TRANSLATION  
Awards for Hitachi Super-TFT

1996  
Nikkei BP Technical Award  
Grand prize

"Super-TFT Technology"  
Capable of realizing the CRT comparative image quality"

Hitachi Co., Ltd.

Mr. Katsumi Kondo, Chief Researcher, Hitachi Research Center, Image  
Device Research Division  
Mr. Masuyuki Ohta, Technical Staff, Electron Tube & Device Division  
Image Development Center  
Mr. Masato Oh-e, Technical Staff, Electron Tube & Device Division  
Image Development Center

The Technology above was selected for the said award of the  
1996 Nikkei BP Technical Award.

Here the award is presented.

April 5, 1996

Nikkei Business Publications, Inc.

Representative, President  
Takashi Suzuki (seal)

YTH TRANSLATION  
Awards for Hitachi Super-TFT

Fujio Commemorative Award

To: Super-TFT Development Group, Hitachi Co., Ltd.

You have cooperated for the research in order to fundamentally improve the viewing angle characteristic which has been the disadvantage of the liquid crystal displays, developed a new liquid crystal display constitution combining the transverse electric field liquid crystal and the TFT technology, and proved the practicability thereof.

The viewing angle in the super-TFT liquid crystal display with the ultra-wide viewing angle of the present research exceeds 140 degrees, and we anticipate that it will make a great contribution to the future development of the image display system.

Here the Fujio Commemorative Award is presented.

May 15, 1996

Television Society, Inc.

President  
Mikio Takagi (seal)

YTH TRANSLATION  
Awards for Hitachi Super-TFT

Official Commendation

The First Advanced Display of the Year '96

Display Module Section

Grand Prix

"Super-TFT Technology"  
Capable of realizing the CRT comparative image quality"

Hitachi Co., Ltd.

You have developed the most superior technology and product of the past year which will make a great contribution to the development of the display industry.

By honoring your accomplishment, the award is presented here,

July 3, 1996

Sponsored by: Display and Imaging

Co-sponsored by: Lead Exhibition Japan, Ltd.

Science Communication International Co., Ltd.

Martin B. Gordon, President (seal)



# Society for Information Display

Celebrating:  
The 100th Anniversary of the Braun Tube  
The 25th Anniversary of the AMSCD

## 1997 International Symposium, Seminar & Exhibition

### Features:

- Four-Hour Short Courses
- Display-Related Seminars
- Applications Seminars
- Technical Sessions
- Applications Sessions
- Poster Session
- Evening Panels
- Exhibition

### Advance Program

Hynes Convention Center  
Boston, Massachusetts

May 11-16 1997

### SID NEWS

International Society for Information Display Awards  
At this year's Symposium, the Society is pleased to honor the following individuals for their important contributions to the display profession and to the Society:

#### Karl Ferdinand Braun Prize

Mr. Isamu Washizuka

"For outstanding contributions to the development of LCDs, in particular to the field of large-area LCDs."

#### Fellow Awards

The following awardees have been made Fellows of the Society:

Dr. Louis D. Silverstein

"For scientific contributions to the design and evaluation of LCDs, including novel methods for display modeling and simulation."

Mr. Eichi Yamaguchi

"For outstanding contributions to the CRT industry, including the development of segmented lens exposure systems, high-resolution data display tubes, and CRT projectors."

Mr. James Ferguson

"For pioneering contributions to the field of liquid crystals and inventive applications to displays."

Dr. Günter Beir

"For pioneering contributions to the understanding and development of LCDs, including the invention of the in-plane-switching effect."

#### Special Recognition Awards

The following awardees will receive special recognition:

Professor Abner Feldman

"For the discovery of anti-ferroelectric liquid crystals and contributions to the understanding of liquid-crystal structures and properties."

Dr. Hisao Makiuchi

"For the development of improved oxide cathodes, innovative CRT technologies, and advances in CRT reliability."

Dr. Bernhard Schauble

"For pioneering contributions to the development of liquid-crystal materials for LCD applications, and for vision and leadership in the growth of this industry."

Mr. Georg Weber

"For pioneering contributions to the development of liquid-crystal materials for LCD applications, and for vision and leadership in the growth of this industry."

Dr. Shoji Shino

"For contributions to the development of low- aberration electron guns and electron-beam simulation techniques."

Mr. Shoji Iwata

"For important contributions to the development of a large-screen color flat-panel CRT."

Mr. Richard E. Holmes

"For entrepreneurship and vision in creating an important market for high-performance projection displays."

#### Best Paper Awards for SID '96

At this year's Symposium, the Society is pleased to award the following individuals for their contributions to SID '96:

#### Best Contributed Paper Award

Dr. A. Mandel, D. Benas, H. Chese, J. Cunningham,  
R. Matzinger, M. R. Meadows, Displaytech, Inc., Boulder, CO;  
D. Ward, Black Forest Engineering, Inc., Colorado Springs, CO  
"Miniature FLC/MOS Color Sequential Display Systems"

#### Best Contributed Paper Award (Honorable Mention)

Dr. H. Honda, I. Yonetani, T. Ose, N. Arimoto,  
Matsushita Electron Tube Development Center, Osaka, Japan;  
K. Shimada, Matsushita Electronics Research Laboratory,  
Osaka, Japan

#### "Development of Yoke for Pure Flat" 17-in. CRT

#### Best Student Paper Award

X. Zhang, B. A. Wandell, Stanford University, Stanford,  
California

#### "A Spatial Extension of CIELAB for Digital Color Image Reproduction"

#### Best Student Paper Award (Honorable Mention)

Dr. H. Schuck, D. J. McKnight, K. M. Johnson, University of  
Colorado at Boulder, Boulder, Colorado  
"Automotive Head-Up Display Using Liquid-Crystal-on-Silicon Displays"

#### Best Applications Paper Award

D. Coates, M. J. Goulding, S. Greenfield, J. M. W. Hammer,  
S. A. Menden, O. L. Parfitt, Marconi Ltd., Dorset, U. K.  
"High-Performance Wide-Bandwidth Reflective Cholesteric Polarizers"

#### Best Poster Paper Award

A. Morita, E. Nishii, Y. Kuba, Koko University, Yokohama, Japan  
"Bright LCD Backlight Using High-Scattering Optical-Trans-  
mission Polymer"

#### Best Poster Paper Award (Honorable Mention)

H. Koma, R. Hasegawa, Sanyo Electric Co., Ltd., Gifu, Japan;  
K. Teraoka, Marconi Ltd., Darmstadt, Germany  
"Development of a Simple Process to Fabricate High-Quality TFT-LCDs"

#### Awards Dinner

The International awards will be presented at the SID Annual Business Meeting on Tuesday, May 13, and the SID '96 Best Paper Awards will be presented at the Annual SID Luncheon on Wednesday, May 14. There will be a dinner honoring all award recipients on Monday evening, May 12, in the Independence Ballroom of the Sheraton Boston Hotel. Tickets for the dinner are available only through pre-registration, and will not be available on-site. (See Advance Registration Form in the centerfold.)

#### Publications

The Society welcomes contributions to its two major publications, the monthly magazine, *Information Display*, and the quarterly journal of the SID. If you would like to submit articles to either or both publications, please contact Information Display editor Ken Werner at 203/853-7089, or Journal editor Alan Sobel at 847/869-5807.

Electronic and CD-ROM Versions of SID '97 Digest  
SID once again plans to publish the SID '97 Symposium Digest electronically on the World Wide Web. The Digest will be directly viewable through commercially available Internet browsers. The papers contained in the Digest will be available for hypertext referencing from subsequent electronically published material on the Web. The Digest will be accessible through a link on the SID home page <http://www.sid.org>.

CD-ROM versions of the SID '96 and SID '97 Digests are planned to be available at SID '97. Please check with the SID registration desk.

Along with technical publications, the SID home page will have information on Society activities, including local chapters and all SID-sponsored conferences. A list of the sustaining members and, when possible, links to their possible home pages will also be available. In addition, a collection of links to other Web display-related information will be assembled.



(12) Wirtschaftspatent

Erteilt gemäß § 17 Absatz 1 Patentgesetz

(19) **DD** (11) **227 809 A1**

4(51) G 02 F 1/13

24.10.84

## AMT FÜR ERFINDUNGS- UND PATENTWESEN

In der vom Anmelder eingereichten Fassung veröffentlicht

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(31) 65240(22) 24.10.84  
(32) 26.04.84(44) 25.09.85  
(33) BG(71) Akademie der Wissenschaften der DDR, 1086 Berlin, Otto-Nuschke-Straße 22/23, DD  
(72) Hauck, Gerd, Dr. Dipl.-Phys., DD; Komitov, Latschesar, Dipl.-Phys., BG; Koswig, Hans-Dieter, Prof. Dr. Dipl.-Phys., DD(54) **Verfahren zur Erzeugung eines Flüssigkristall-Bauelementes mit verdrehter Struktur**

(57) Die Erfindung betrifft ein Verfahren zur Erzeugung von Flüssigkristall-Bauelementen für den Einsatz auf dem Gebiet der Elektronik und in Systemen zur Informationsdarstellung. Es ist die Aufgabe der Erfindung, ein Verfahren zur Erzeugung von Flüssigkristall-Bauelementen mit verdrehter Struktur anzugeben, die sich durch gute Reproduzierbarkeit und Homogenität über die gesamte Fläche auszeichnen. Erfindungsgemäß wird die Aufgabe dadurch gelöst, daß an eine Flüssigkristallschicht, die zwischen zwei Glasplatten angeordnet ist und eine positive dielektrische Anisotropie und eine anfängliche Deformation vom Verbiegungstyp aufweist, ein ungefähr parallel zu den Platten ausgerichtetes elektrisches Feld angelegt wird, dessen Stärke unter einem für den Freedericksz-Übergang notwendigen Wert liegt.

ISSN 0433-6461

6 Seiten

## Verfahren zur Erzeugung eines Flüssigkristall-Bauelementes mit verdrehter Struktur

### Anwendungsgebiet der Erfindung

Die Erfindung betrifft die Erzeugung von Flüssigkristall-Bauelementen mit verdrehter Struktur, wie sie in der Elektronik und in Systemen zur Informationsdarstellung benötigt werden.

### Charakteristik der bekannten technischen Lösungen

Es ist, wie von G. Porte in J. Physique 37 (1976) 1245, 38 (1977) 509 und 39 (1978) 213 beschrieben, bekannt, Flüssigkristall-Bauelemente mit verdrehter Struktur zu erzeugen. Hiernach befindet sich zwischen zwei Glasplatten eine Flüssigkristallschicht, die unter dem Einfluß der Plattenoberflächen so deformiert wird, daß die Ebene ihrer Deformation ungefähr senkrecht zu den Glasplatten liegt und die Neigung der Flüssigkristallmoleküle nahe der einen Platte umgekehrt zu jener an der anderen ist. Um eine Verdrehung in eine  $180^\circ$ -Struktur der Flüssigkristallschicht herbeizuführen, muß die Neigung jener Moleküle, die sich in der Nähe der Glasplatten befinden, eine bestimmte, gegenüber der Normalen zur Platte gemessene kritische Größe überschreiten. Dies wird durch den gleichzeitigen Einfluß einer vorher auf die Platteninnenseiten aufgetragenen Schicht einer oberflächenaktiven Substanz und der beim Einfüllen entstehenden Flüssigkristallströmung auf die Orientierung der Flüssigkristallmoleküle erreicht.

Nachteilig ist, daß keine Reproduzierbarkeit gewährleistet werden kann und die so erzeugten Flüssigkristall-Bauelemente

mit verdrehter Struktur über die gesamte Fläche stark ausgeprägte Inhomogenitäten aufweisen.

#### Ziel der Erfindung

Ziel der Erfindung sind Flüssigkristall-Bauelemente mit verdrehter Struktur mit besseren Gebrauchseigenschaften.

#### Darlegung des Wesens der Erfindung

Die Aufgabe der Erfindung besteht darin, ein Verfahren zur Erzeugung von Flüssigkristall-Bauelementen mit verdrehter Struktur anzugeben, die sich durch gute Reproduzierbarkeit und Homogenität über die gesamte Fläche auszeichnen.

Diese Aufgabe wird dadurch gelöst, daß in bekannter Weise zwischen zwei Glasplatten eine Flüssigkristallschicht angeordnet ist, die unter dem Einfluß der Plattenoberflächen so deformiert wird, daß die Ebene ihrer Deformation ungefähr senkrecht zu den Glasplatten liegt und die Neigung der Flüssigkristallmoleküle nahe der einen Platte umgekehrt zu jener an der anderen ist.

Erfindungsgemäß wird an die Flüssigkristallschicht mit positiver dielektrischer Anisotropie ( $\Delta\epsilon > 0$ ) und einer anfänglichen Deformation vom Verbiegungstyp ein in Richtung zu den Glasplatten ungefähr parallel wirkendes elektrisches Feld angelegt, dessen Stärke  $E$  unter dem für einen Fredericksz-Übergang notwendigen Wert  $E_{th}$  liegt. Auf diese Weise ist es möglich, gut reproduzierbare und über die gesamte Fläche homogene Flüssigkristall-Bauelemente mit verdrehter Struktur zu erhalten.

#### Ausführungsbeispiel

Nachstehend soll die Erfindung an einem Ausführungsbeispiel erläutert werden. Wie Fig. 1 und 2a zeigen, ist zwischen den beiden Glasplatten 1 und 2 eine Flüssigkristallschicht 3 mit positiver dielektrischer Anisotropie ( $\Delta\epsilon > 0$ ) angeordnet. Unter dem Einfluß der Plattenoberflächen ist diese Schicht deformiert, wobei ihre Deformationsebene etwa senkrecht zu

den Glasplatten 1 und 2 liegt. Die Neigung der Flüssigkristallmoleküle nahe der einen Platte ist umgekehrt zu jener an der anderen und ihre Orientierung in der Schichtmitte ist ungefähr senkrecht zu den Glasplatten (Deformation vom Verbiegungstyp). Mittels der Elektroden 4, die in geeigneter Weise auf den Innenseiten der Platten angeordnet sind, wird gemäß Fig. 2b an die Flüssigkristallschicht ein parallel zu den Glasplatten gerichtetes elektrisches Feld angelegt. Ist dessen Feldstärke  $E$  geringer als jene ( $E_{th}$ ), die für den Freedericksz-Übergang notwendig ist, verändert sich die anfängliche Deformation der Schicht und geht von der Verbiegung in eine Verdrillung um  $180^\circ$  über.

## Erfindungsanspruch

Verfahren zur Erzeugung eines Flüssigkristall-Bauelementes mit verdrehter Struktur, bei dem sich zwischen zwei Glasplatten eine Flüssigkristallschicht befindet, die unter dem Einfluß der Plattenoberflächen so deformiert ist, daß die Deformationsebene etwa senkrecht zu den Glasplatten steht und die Neigung der Flüssigkristallmoleküle nahe der einen Platte umgekehrt zu jener an der anderen ist, gekennzeichnet dadurch, daß an die Flüssigkristallschicht mit positiver dielektrischer Anisotropie und einer anfänglichen Deformation vom Verbiegungstyp ein ungefähr parallel zu den Platten ausgerichtetes elektrisches Feld angelegt wird, dessen Stärke unter einem für den Freedericksz-Übergang notwendigen Wert liegt.

Hierzu 1 Blatt Zeichnungen

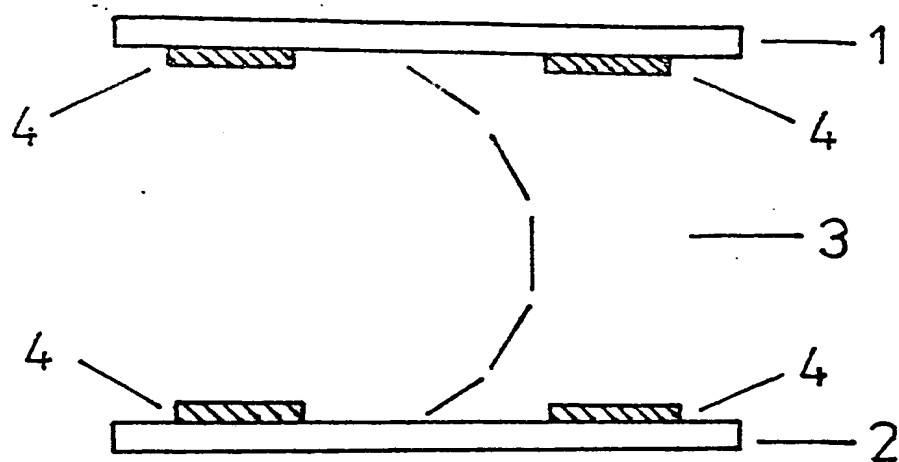


Fig. 1

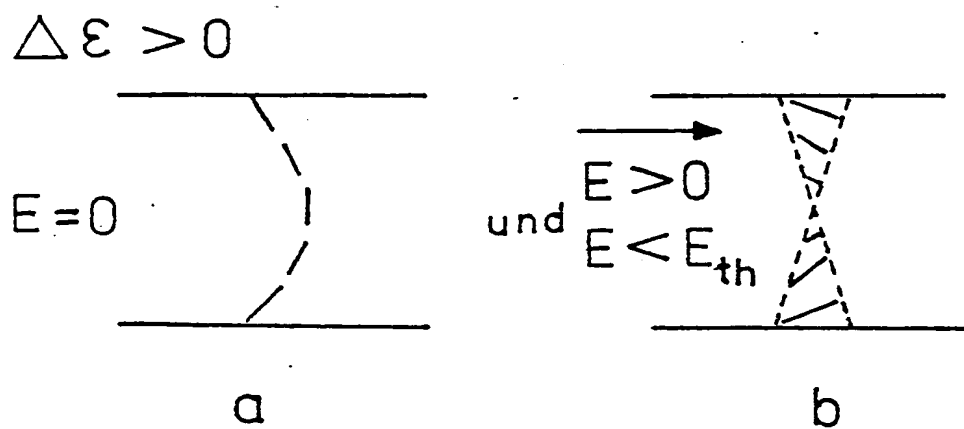


Fig. 2

**Process for producing a liquid-crystal component having a twisted structure**

The invention relates to a process for producing liquid-crystal components for use in the area of electronics and in systems for information display. The object of the invention is to indicate a process for producing liquid-crystal components having a twisted structure which are distinguished by good reproducibility and homogeneity over the entire area. The object is achieved in accordance with the invention by subjecting a liquid-crystal layer which is arranged between two glass plates and has a positive dielectric anisotropy and an initial deformation of the bend type, to an electric field which is aligned approximately parallel to the plates and whose strength is below a value which is necessary for the Freedericksz transition.

Process for producing a liquid-crystal component having a twisted structure

#### Field of the invention

5           The invention relates to the production of liquid-crystal components having a twisted structure, as required in electronics and in systems for information display.

#### 10           Characteristics of the technical solutions

          It is known, as described by G. Porte in J. Physique 37 (1976) 1245, 38 (1977) 509 and 39 (1978) 213, to produce liquid-crystal components having a twisted structure. According to this, a liquid-crystal  
15   layer is located between two glass plates and is deformed under the influence of the plate surfaces in such a way that the plane of its deformation is approximately perpendicular to the glass plates and the tilt of the liquid-crystal molecules close to one plate  
20   is opposite to that at the other. In order to effect a twist into a 180° structure of the liquid-crystal layer, the tilt of each molecule located close to the glass plates must exceed a certain critical value measured against the perpendicular to the plate. This  
25   is achieved by the simultaneous effect of a layer of a surfactant applied in advance to the insides of the plates and the liquid-crystal flow, produced on filling, toward alignment of the liquid-crystal molecules.

30           It is disadvantageous that reproducibility cannot be ensured, and the resultant liquid-crystal components having a twisted structure have markedly different degrees of inhomogeneity over the entire area.

35

#### Aim of the invention

          The aim of the invention are liquid-crystal components having a twisted structure and improved service properties.

40

## Description of the essence of the invention

5 The object of the invention is to indicate a process for producing liquid-crystal components having a twisted structure which are distinguished by good reproducibility and homogeneity over the entire area.

10 This object is achieved by arranging, in a known manner, a liquid-crystal layer between two glass plates, which layer is deformed under the effect of the plate surfaces in such a way that the plane of its deformation is approximately perpendicular to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other.

15 In accordance with the invention, an electric field acting in the direction approximately parallel to the glass plates with a strength  $E$  below the value  $E_{th}$  necessary for a Freedericksz transition is applied to the liquid-crystal layer having positive dielectric anisotropy ( $\Delta\epsilon > 0$ ) and an initial deformation of the bend type. In this way, it is possible to achieve highly reproducible liquid-crystal components having a twisted structure which are homogeneous over the entire area.

25

## Illustrative embodiment

30 The invention is explained below with reference to an illustrative embodiment. As shown by Fig. 1 and 2a, a liquid-crystal layer 3 having positive dielectric anisotropy ( $\Delta\epsilon > 0$ ) is arranged between two glass plates 1 and 2. Under the influence of the plate surfaces, this layer is deformed, its deformation plane being approximately perpendicular to the glass plates 1 and 2. The tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, and their alignment in the centre of the layer is approximately perpendicular to the glass plates (deformation of the bend type). By means of the electrodes 4, which are arranged in a suitable manner on the insides of the

plates, an electric field aligned parallel to the glass plates is applied to the liquid-crystal layer as shown in Fig. 2b. If its field strength  $E$  is lower than that ( $E_{th}$ ) necessary for the Freedericksz transition, the  
5 initial deformation of the layer changes and is converted from bend into a twist of  $180^\circ$ .

Claim

Process for producing a liquid-crystal component having a twisted structure, in which a liquid-crystal layer is located between two glass plates and is deformed under the influence of the plate surfaces in such a way that the plane of deformation is approximately perpendicular to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, characterized in that an electric field which is aligned approximately parallel to the plates and whose strength is below a value which is necessary for the Freedericksz transition is applied to the liquid-crystal layer having positive dielectric anisotropy and an initial deformation of the bend type.

In addition 1 sheet of drawings

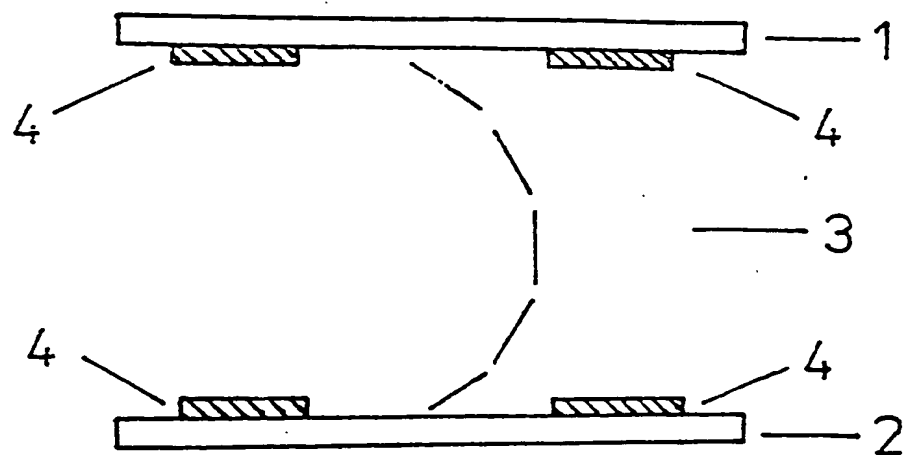


Fig. 1

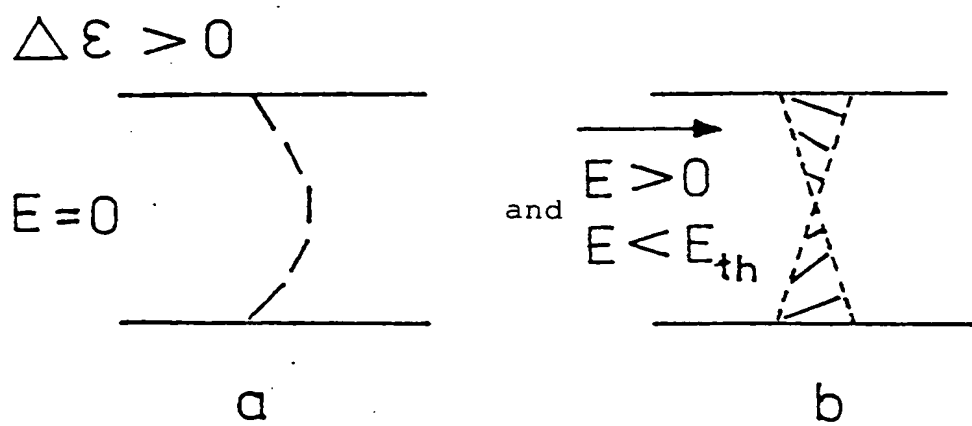


Fig. 2

**Process for producing a liquid-crystal component having a twisted structure**

The invention relates to a process for producing liquid-crystal components for use in the area of electronics and in systems for information display. The object of the invention is to produce liquid-crystal components having a twisted structure which are distinguished by good reproducibility and homogeneity over the entire area. The object is achieved in accordance with the invention by subjecting a liquid-crystal layer which is arranged between two glass plates and has a positive dielectric anisotropy and an initial deformation of the splay type, to an electric field which is aligned approximately parallel to the plates and whose strength is above a value which is necessary for the Freedericksz transition.

# Process for producing a liquid-crystal component having a twisted structure

## Field of the invention

5           The invention relates to the production of liquid-crystal components having a twisted structure, as required in electronics and in systems for information display.

## 10           Characteristics of the technical solutions

          It is known, as described by G. Porté in J. Physique 37 (1976) 1245, 38 (1977) 509 and 39 (1978) 213, to produce liquid-crystal components having a twisted structure. According to this, a liquid-crystal  
15   layer is located between two glass plates and is deformed under the influence of the plate surfaces in such a way that the plane of its deformation is approximately perpendicular to the glass plates and the tilt of the liquid-crystal molecules close to one plate  
20   is opposite to that at the other. In order to effect a twist into a 180° structure of the liquid-crystal layer, the tilt of each molecule located close to the glass plates must exceed a certain critical value measured against the perpendicular to the plate. This  
25   is achieved by the simultaneous effect of a layer of a surfactant applied in advance to the insides of the plates and the liquid-crystal flow, produced on filling, toward alignment of the liquid-crystal molecules.

30           It is disadvantageous that reproducibility cannot be ensured, and the resultant liquid-crystal components having a twisted structure have markedly different degrees of inhomogeneity over the entire area.

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## Aim of the invention

          The aim of the invention are liquid-crystal components having a twisted structure and improved service properties.

## Description of the essence of the invention

The object of the invention is to indicate a process for producing liquid-crystal components having a twisted structure which are distinguished by good  
5 reproducibility and homogeneity over the entire area.

This object is achieved by arranging, in a known manner, a liquid-crystal layer between two glass plates, which layer is deformed under the influence of the plate surfaces in such a way that the plane of its  
10 deformation is approximately [lacuna] to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other.

In accordance with the invention, an electric field acting in the direction approximately parallel to the glass plates with a strength  $E$  above the value  $E_{th}$   
15 necessary for a Freedericksz transition is applied to the liquid-crystal layer having negative dielectric anisotropy ( $\Delta\epsilon < 0$ ) and an initial deformation of the splay type. In this way, it is possible to achieve  
20 highly reproducible liquid-crystal components having a twisted structure which are homogeneous over the entire area.

## Illustrative embodiment

25 The invention is explained below with reference to an illustrative embodiment. As shown by Fig. 1 and 2a, a liquid-crystal layer 3 having negative dielectric anisotropy ( $\Delta\epsilon < 0$ ) is arranged between two glass plates 1 and 2. Under the influence of the plate surfaces,  
30 this layer is deformed, its deformation plane being approximately perpendicular to the glass plates 1 and 2. The tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, and their alignment in the centre of the layer is approximately  
35 parallel to the glass plates (deformation of the splay type). By means of the electrodes 4, which are arranged in a suitable manner on the insides of the plates, an electric field aligned parallel to the glass plates is applied to the liquid-crystal layer. If its field

strength  $E$  is greater than that of  $E_{th}$ , this deformation of the splay type is converted into the bend type (Fig. 2b), where the alignment of the molecules close to the glass plates is retained, but in the centre of the  
5 layer becomes virtually perpendicular to the plates. At a field strength of  $E < E_{th}$  or if the field disappears ( $E = 0$ ), the deformation of the bend type relaxes to give a twist into a  $180^\circ$  structure of the liquid-crystal layer (Fig. 2c).

Claim

Process for producing a liquid-crystal component having a twisted structure, in which a liquid-crystal layer is located between two glass plates and  
5 is deformed under the influence of the plate surfaces in such a way that the plane of deformation is approximately perpendicular to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, characterized in that an  
10 electric field which is aligned approximately parallel to the plates and whose strength is above a value which is necessary for the Freedericksz transition is applied to the liquid-crystal layer having negative dielectric anisotropy and an initial deformation of the splay  
15 type.

In addition 1 sheet of drawings

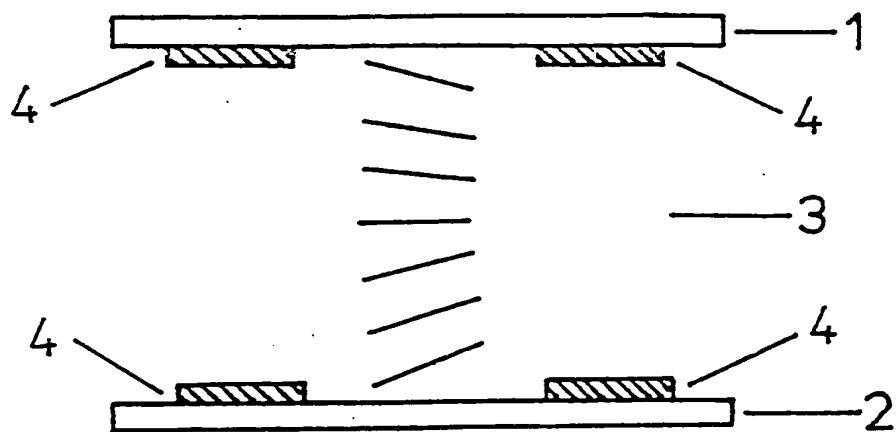


Fig.1

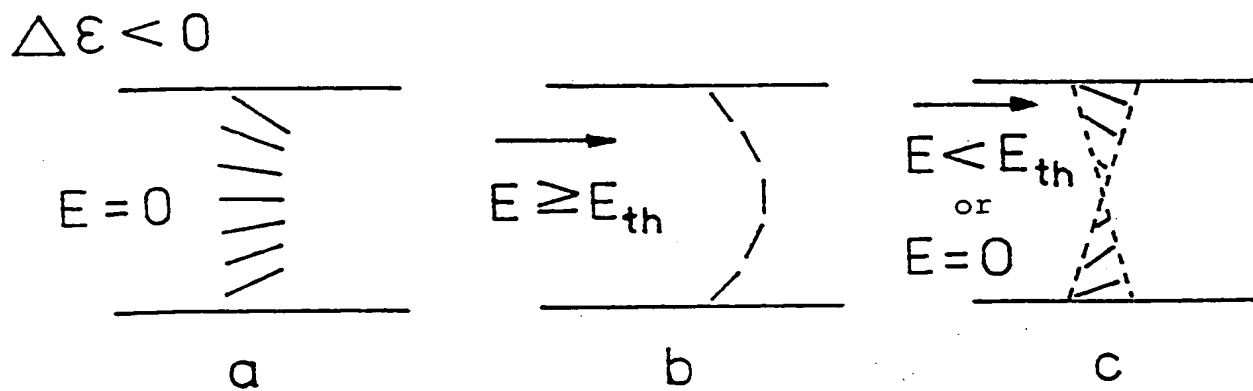


Fig.2

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